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(54) Title: GEL FORM OF A VACCINE

(57) Abstract

The present invention provides for a gel form of a live vaccine for administration of live vaccine to poultry hatchlings. The gel form comprises approximately 1.5 to 5.0 percent of an edible polysaccharide temperature setting gelling agent having suspended therein sufficient levels of a live vaccine to provide for immunization of a poultry hatchling flock. The present invention also provides a method for immunizing a poultry flock utilizing a live vaccine of viable organisms, the method comprising preparing a gel form of a live vaccine by preparing a suspension of the viable organisms in cold water, dissolving an edible polysaccharide temperature setting gelling agent in an aqueous solution at or above the melting point of the polysaccharide gelling agent, mixing the organism suspension and the gelling agent solution, pouring the mixture into a suitable container then allowing the mixture to cool and gel to produce a gelled live vaccine comprising from about 1 to about 2.5 percent of an edible polysaccharide gel having suspended therein sufficient levels of the organism to provide immunization to the flock and allowing the poultry flock to feed from the gelled vaccine suspension.

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TITLE: GEL FORM OF A VACCINE

FIELD OF THE INVENTION

The present invention relates to a gel form for administration of live vaccines and supplements to poultry hatchlings and methods for such administration.

BACKGROUND OF THE INVENTION

At the present time, poultry hatchlings, within the first few days of life, are required to be immunized against various diseases and the type of vaccine used for each disease dictates its method of administration. Attenuated vaccines are usually administered in the hatchery by injection at the time of sorting of the hatchlings from the hatching incubator into holding or transporting trays. Live vaccines are more commonly administered once the hatchlings are established in their brooding trays in the form of aqueous suspensions either sprayed on feed or added to the drinking water.

One example of a live vaccine is that used to immunize poultry against coccidiosis caused by protozoa of the genus Eimeria. Coccidiosis is a very common disease of poultry and there are several species of Eimeria which are known to cause such disease. The symptoms and severity of the disease are dependent upon the species of Eimeria with which the bird is infected with E.tenella, E.acervulina and E.maxima being three of the most prevalent species. At the present time, the protection of poultry against coccidiosis involves two possible methods - use of anticoccidials as feed additives or immunization using a coccidiosis vaccine with immunization being increasingly the preferred route. Coccidiosis vaccines are at present comprised of virulent strains of coccidia in a suitable carrier for administration, the coccidia being capable of causing a

mild form of the disease and selected to be very anticoccidial susceptible.

One common method of immunization against coccidiosis involves the use of on-feed spray administration while the birds are feeding from flats or other containers. A vaccine comprising oocysts of *Eimeria* species in a water based carrier is sprayed onto the feed to be provided to the hatchlings. The use of on-feed spray administration requires large doses of oocysts and uniform exposure of the flocks to the vaccine cannot always be achieved.

Vaccine may also be administered through the use of water proportioning systems including automatic fountains and automatic water medicator or proportioners. However, given the particulate nature of coccidiosis vaccines, it is doubtful that the vaccine may actually make it to the end of the water line, resulting in uneven exposure of the flock. Additionally, administration of the vaccine through the water proportioning system requires that after administration of the vaccine, the proportioning system be thoroughly cleaned to remove any residual vaccine.

Poultry hatchlings are at present generally immunized against coccidiosis after they are 3 to 4 days old. By delaying this immunization until this point in time, the chicks are fully in the feeding cycle and are able to become immunized through the use of the vaccine either on the feed or through the drinking water.

It would, however, be advantageous to immunize the hatchling at an earlier stage, preferably within the hatchery. By doing this, lower doses of oocysts may be required for immunization and the oocysts may be administered as part of the drinking water which is used as

the inducement for the commencement of the feeding cycle. The administration of vaccine in the drinking water requires that the oocysts remain suspended to provide for even exposure of the flock. One solution to this has been proposed by the present applicant in Canadian Patent 1,204,057, which involves suspending the oocysts in a 1.5% carrageenan solution. While this method has numerous advantages, such as reduced levels of oocysts necessary to provide immunization as well as ease of administration, there is still a drawback in that the provision of open watering systems to hatchlings could result in the liquid being spilled or wetting the hatchlings which could potentially affect the health of the hatchlings, especially in cold weather and during transportation.

There thus remains a need for a simplified vaccine for administration to day-old hatchlings in the hatchery, which provides adequate protection of the flock while reducing potential problem areas.

SUMMARY OF THE INVENTION

The present invention provides for a gel form of a live vaccine for administration of live vaccine to poultry hatchlings. The gel form comprises approximately 1 to 2.5 percent of an edible polysaccharide temperature setting gelling agent having suspended therein sufficient levels of a live vaccine to provide for immunization of a poultry hatchling flock.

In an aspect of the invention, there is provided a method for immunizing a poultry flock utilizing a live vaccine of viable organisms, the method comprising preparing a gel form of a live vaccine by preparing a suspension of the viable organisms in cold water, dissolving an edible polysaccharide temperature setting gelling agent in an aqueous solution at or above the

melting point of the polysaccharide gelling agent, mixing the organism suspension and the gelling agent solution, pouring the mixture into a suitable container then allowing the mixture to cool and gel to produce a gelled live vaccine comprising from about 1 to about 2.5 percent of an edible polysaccharide gel having suspended therein sufficient levels of the organism to provide immunization to the flock and allowing the poultry flock to feed from the gelled vaccine suspension.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In a poultry hatchery, at the time of emergence of the hatchlings from their shells in the incubation trays, they are generally examined for defects, immunized with poultry vaccines by injection and then sorted by sex and placed into holding or transporting trays. At this time they may also be administered aqueous based live vaccines through a suitable means such as gavage (direct oral administration). Once in the brooding trays, the chicks may also be administered live vaccine by means of the watering system or by means of on feed spray. Aqueous-based live vaccines are generally particulate in nature and if administered in the watering system, the vaccines should be provided in a composition which will maintain a relatively uniform suspension of the organisms in the vaccine. This is particularly true for coccidiosis vaccines which consist of relatively large oocysts of Eimeria species. Coccidiosis vaccines are usually administered orally for immunizing domestic animals of the avian species from coccidiosis, the vaccine having oocysts of at least one coccidium in relation to which the immunization is desired.

The present invention in a preferred embodiment provides for a gel form of a coccidiosis vaccine in which the oocysts of the coccidium are diluted and suspended in a

gel form which results in maintaining an uniform suspension of the oocysts and consequently, relatively uniform infection of the flock by the oocysts. The gel form of the present invention is particularly useful with Eimeria species, more particularly with Eimeria tenella or other species such as Eimeria necatrix, Eimeria hagani, Eimeria acervulina, Eimeria maxima, Eimeria brunetti, Eimeria proecox, Eimeria mivati and Eimeria mitis are also useful. The method of obtaining each of these species is well-known by those skilled in the art. Two or more species of Eimeria can be used simultaneously and in the practice of the present invention, it is generally not necessary to use more than six species together in the same suspension.

The gel form vaccine of the present invention provides for an easy to handle method of vaccinating poultry hatchlings in the hatchery and is, therefore, suitable for general hatchery workers without any special expertise required. The gel form is produced utilizing an edible temperature setting polysaccharide gel, preferably a low temperature setting alginate or carrageenan gel, most preferably the kappa carrageenan gel sold as refined carrageenan Bengel MB 910, a water soluble kappa-type carrageenan extracted from the red algae Eucheuma cottonii.

The gel form of the vaccine is prepared by dissolving the gel powder in water at a suitable temperature to effect complete dissolution of the polysaccharide powder. The powder is added to the water at a concentration such that, when mixed with the oocyst suspension and allowed to gel, a relatively soft gel results. Typically, the dissolved gel powder and oocyst suspension are mixed in a ratio of about 1:1(v:v) to prepare the gel form of the vaccine. Suitable such gel forms have been found to have a final concentration of the edible polysaccharide in the gel form of between about 1 and 2.5 percent, preferably between about 1 and 2 percent,

more preferably between about 1.25 and 1.75 percent and most preferably about 1.25 percent. Thus preferably, a dissolved polysaccharide gel solution of about 2 to 5 percent, preferably about 2 to 4 percent, more preferably about 2.5 to 3.5 percent, most preferably about 2.5 percent, is mixed with an equal volume of a suspension of oocysts and the mixture allowed to gel at a suitable temperature.

The gel form vaccine of the present invention has sufficient levels of the oocysts to provide immunization to the flock. It has been found that each hatchling will consume about 0.5 to 1.5 ml of the gel and the concentration of the oocysts in the gel should be such as to provide sufficient organisms in this typical volume to immunize the hatchling. It has been found that between about 50 and 1,000 oocysts per bird provides adequate protection and so it is preferred if the gel form of the vaccine has between about 100 and 500 oocysts per ml of gel, to provide for proper immunization of the flock. Preferably, the gel form of the vaccine contains between about 200 and 300 oocysts per ml of gel, most preferably about 250 oocysts per ml of gel. As the gel form is prepared by mixing the dissolved polysaccharide powder with the oocyst suspension in equal volumes, preferably one volume of a 2 to 5 % polysaccharide gel solution is mixed with an equal volume of oocyst suspension containing between about 200 and 1,000 oocysts per ml, more preferably one volume of a 2 to 4 percent polysaccharide solution with an equal volume of oocyst suspension containing between about 400 and 600 oocysts per ml, most preferably a 2.5 percent solution of polysaccharide is mixed with an equal volume of oocyst suspension containing about 500 oocysts per ml.

The use of this edible temperature setting polysaccharide form does not require the use of catalyst

systems. Catalyst systems such as CMC generally require more careful handling particularly during the gelling process. If the concentrations of catalyst and gel compound are not properly adjusted, the gelling of the solutions may occur too quickly and may not permit sufficient mixing to provide for a uniform suspension of the parasites. The use of the edible polysaccharide gels of the present invention results in a gel which preferably forms in about 3 to 5 minutes at 4°C, maintains the vaccine organisms in uniform suspension and allows for more uniform exposure of the poultry hatchlings to the vaccine organisms. The low content of the edible gum in the gel form means that approximately 95 percent or more of the gel form is water which can aid in the hydration of the bird and induce the feeding response. The gel form has other advantages over liquid suspensions in that the gel form will not wet the bird and therefore will not affect the health of the chicks, particularly in winter when, if the hatchling becomes wet through exposure to aqueous solution, the exposure may cause death of the hatchling. The use of the edible polysaccharide gel of the present invention which gels at a relatively low temperature is also suitable for adding nitrogen nutrients and other additives such as vitamins to the gel form or competitive exclusion products such as "BROILACT" sold by Orion Corp., Finland. This is especially useful with heat sensitive nutrients which, if exposed to temperatures over about 50°C, are denatured or inactivated. The use of the gel form vaccine of the present invention also realizes a saving in the hatchery in that as the gel form is 95 percent or more water, additional watering systems are not needed such as a built-in watering system. This not only reduces the costs of operation of the hatchery but also reduces the likelihood of the spilling of water and wetting of the chicks which can affect the health of the birds.

The use of the vaccine in accordance with the invention is illustrated in the following examples but the invention is not limited thereto. In all of the examples where it is stated that the animals were exposed to oocysts, it should be understood that the vaccine, being the oocysts in the gel form, was not fed to the bird manually, the birds were simply placed in the same area as the gel form vaccine during the time period and were allowed to consume the vaccine voluntarily. Eimeria tenella and Eimeria necatrix are used in the example because they are the two most pathogenic species among the six commonly found coccidia which causes coccidiosis in chickens. They are, however, the two least immunogenic species, that is, they produce the least protection against immunization. Hence, if an immunization method is effective against Eimeria tenella or Eimeria necatrix, it would be effective for the remaining species. Eimeria tenella is the preferred species for experimentation partly because it is more prevalent than Eimeria necatrix and is the main cause of death among chickens suffering from coccidiosis. In addition, because Eimeria tenella appears almost exclusively in the ceca of chickens instead of infecting all over the intestines, like other species, the damage or lesions can be accurately scored.

Example 1

A vaccine according to the present invention was prepared by first adding 200 ml of hot tap water to 5 gm of kappa carrageenan Bengel MB 910 in a container and mixing until the MB 910 had dissolved. To this solution was added 200 ml of a solution containing 500 oocysts per ml of a mixture of Eimeria acervulina, E.maxima and E.tenella and the combined solution was mixed. The solution was then poured into a plastic watering dish and allowed to cool and gel at 4°C. This resulted in a gel form of the vaccine containing 1.25 percent MB 910 and 250 oocysts per ml.

Example 2

33 broilers, each one day old, were divided into three groups of 11 birds each. Each group was immunized by exposure to Eimeria tenella by one of three methods. One group was immunized by use of a heavy dose spray cabinet, the second group was immunized by a heavy dose of oocysts suspended in a 1.5 percent carrageenan solution produced in accordance with Canadian Patent 1,204,057 and the third group was exposed to the gel form vaccine of the present invention prepared in accordance with Example 1 above. Each of the birds were weighed at the start and at the end to calculate the average weight gain and were also scored for lesions in the intestinal tract. The results of the experiment are set out in the following table:

TABLE 1

	Ave. Weight Gain (g)	Presence of Lesions			Average Lesion Score		
		U	M	C	U	M	C
Spray Cabinet	67	6/11	4/11	2/11	0.4	0.4	0.1
Heavy Dose Liq.	72	10/11	6/11	6/11	1.2	0.9	0.6
Heavy Dose Gel	77	11/11	11/11	6/11	1.3	1.2	0.6

The above results are utilized to illustrate the immunization of birds by the various forms of vaccine. Of most relevance to the immunizing capability of vaccine are the results of the lesions in the mid region of the gut, both the presence of lesions as well as the average lesions score. As can be seen, the gel form vaccine of the present invention provided complete immunization of the 11 birds as opposed to the only partial immunization of the group by the spray cabinet and the liquid administration methods.

Example 3

480 Day old 8015 male broiler chickens were divided into four treatment groups and housed in a floor-pen house. Group A was a control group given a water placebo. Group B was given via gavage an aqueous suspension vaccine prepared in accordance with Canadian Patent 1,209,057 that included Eimeria acervulina, E. maxima and E. tenella, in a 1.5 percent carrageenan solution. Group C was given the gel form vaccine of the present invention prepared following the method of Example 1. Group D was given a water placebo and placed on low energy roaster starter feed medicated with 1.25 lbs of "MAXIBAN" feed additive-coccidiocide marketed by Elanco, a division of Eli Lilly Canada Inc. Groups A to C were placed on unmedicated feed. The birds were divided up into 4 pens of 30 birds (4 x 30 = 120 birds) for each treatment Group (A-D). At 29 days post immunization (PI), birds and feed from all Groups were weighed and feed was changed to low energy roaster grower. Group C continued to be maintained on medicated feed (1.00 lb "MAXIBAN"). Birds and feed were again measured at 59 days PI and feed was changed to roaster withdrawal feed. All groups received unmedicated feed during withdrawal until 70 days PI. The parameters of average weight gain, feed conversion, and mortality were measured for all cages at 29, 59 and 70 days PI. Lesion scores were done on 5 birds/pen (total of 20 birds/treatment group) on day 29.

TABLE 2

Treatment	4 Weeks Ave. Wt.	4 Weeks Ave.Wt. Gain	5 Weeks Ave. Wt.	5 Weeks Ave.Wt. Gain	Lesion Score Upper	Lesion Score Mid	Lesion Score Cecum	4 Wks Feed Eff.
UI-UC Pens 1-4	914	869	1510	1459	0.08	1.00	0.20	1.66
Gavage I Pens 5-8	904	857	1500	1451	1.00	1.50	0.40	1.68
Gel I Pens 9-12	913	864	1490	1440	0.05	0.60	0.00	1.64
Medicated Pens 13-16	964	917	1570	1511	0.00	0.20	0.00	1.65

UI=unimmunized
I=immunized
weight is in grams

From the above results it can be seen that the weight gain and feed efficiency of all four groups is approximately equal.

The birds of Groups A to C were then challenged at three weeks with a challenge dose of 25,000 oocysts per bird and the parameters of weight gain, feed conversion and lesion scores were measured for all cages.

TABLE 3

Treatment	Ave. Weight	Ave. Wt. Gain	Feed Conversion	Lesion Scores Upper	Lesion Scores Mid	Lesion Scores Cecum
UI-UC	865	304	1.62	0.0	0.0	0.0
UI-C	773	184	2.36	3.3	3.4	1.6
I Gel-UC	833	276	1.67	0.0	0.0	0.0
I Gel-C	826	203	2.06	2.5	3.0	0.8
I Gavage-UC	904	309	1.60	0.0	0.0	0.0
I Gavage-C	772	182	2.58	3.5	3.4	0.8
Medicated-UC	899	307	1.71	0.0	0.0	0.0

UC=unchallenged
C=challenged

From the results shown in Table 3, immunization with the gel form vaccine of the present invention provided better protection to the birds against the high dose oocyst challenge having lesion scores lower than those immunized by gavage. In addition, surprisingly, the feed conversion and weight gain of these birds was much better than that of the gavage immunized group.

Example 4

The effectiveness of the gel form of the vaccine of the present invention was confirmed using flocks of commercial broilers. Flocks were either maintained on a medicated feed with Salinomycin (COXISTAC™) or Virginiamycin (STAFAC™) or were immunized utilizing a vaccine prepared according to Canadian Patent 1,204,057 or a gel form of the vaccine as prepared by a modified method according to Example 1. The gel form of the vaccine was prepared using a double strength oocysts suspension prepared in a 1.5% carrageenan solution as set out in Canadian Patent 1,204,057. The dissolved carrageenan MB 910 gel solution was prepared by dissolving the powder in 65°C water at a concentration of 2.5%. The two solutions were mixed together, poured into sausage sleeves and chilled with the gel forming in approximately 5 minutes. The sausage sleeves were sliced into 100 g slices with each slice designed for one tray or 100 birds. Consumption of the gel form was complete anywhere between 30 minutes and 2 hours. The effectiveness of the immunization by the gel form vaccine was investigated by examining ten fecal samples from each floor weekly by preparing a smear of the fecal sample and examining this under a microscope. The results of the fecal samples are as shown in Table 4.

TABLE 4

	Number of Positive Fecal Samples		
	Bottom Floor	Middle Floor	Top Floor
Week 1	2/10	3/9	4/9
Week 2	7/9	5/9	8/10
Week 3	10/10	11/11	10/10

As can be seen, by three weeks post-administration of the vaccine, there was complete immunization of the flock with all species of Eimeria present in all fecal samples.

Three weeks after immunization, 16 birds were removed from various pens, maintained separately and then challenged at 5 weeks post-immunization with heavy doses of E. tenella, E. acervuline and E. maxima. The results as shown in the following Table demonstrate the effectiveness of the vaccine. The average lesions in upper, middle guts and ceca were substantially higher in the control birds than in the vaccinated birds.

TABLE 5

		Average Lesion Score		
	No. of Birds	Upper	Middle	Ceca
Control	7*	3.3	0.9	3.3,3.4
Bottom Floor	6	0	0	0.2,0.1
Middle Floor	6	0	,0	0.3,0.2
Top Floor	6	0	0	0.1,0.2

* one bird died

The birds were marketed at 41 days old and the birds immunized with the gel form vaccine had an average weight of 2.11 kg and a feed conversion of 1.91. The

mortality of two flocks immunized with the gel form of the vaccine was 4.2% out of 46,818 cockerels placed and condemnation was 0.87%. The flock of 23,052 cockerels immunized by the hatchery method using the vaccine of Canadian Patent 1,204,057 had an average weight of 2.02 Kg and a fee conversion rate of 1.92. In contrast, four crops of birds totally 102,506 cockerels and pullets medicated with Salinomycin and Virginiamycin sold at 41 days had an average weight of 1.99 kg with a feed conversation of 1.88. These results are illustrated in the following table.

TABLE 6

Date	No. of Birds Placed	Mortality (%)	Age (days)	Condm (%)	Avg. Wt KG (lbs)	FCR
MEDICATION						
7/94	28,050[a]	4.0	41	0.75	1.82(4.00)	1.95
9/94	26,826[b]	3.9	41	0.47	2.08(4.58)	1.86
11/94	24,578[a]	4.1	40	0.52	1.98(4.36)	1.83
1/94	23,052[a]	3.5	41	0.82	2.08(4.58)	1.88
Average		3.9	40.8	0.64	1.99(4.39)	1.88
IMMUNIZATION						
3/95	23,052[c]	3.6	41	0.22	2.02(4.44)	1.92
5/95	24,174[d*]	5.8	42	0.59	2.16(4.76)	1.87
7/95	22,644[d]	2.5	40	1.14	2.06(4.54)	1.94
Average		4.2	41	0.87	2.11(4.65)	1.91

a: Coxistac, 1/2 cockerels and 1/2 pullets
b: Coban
c: Hatchery method
d: Gel method
*: Staph infection within first week

The gel form vaccine of the present invention provides for an easy to handle method of vaccinating poultry hatchlings in the hatchery and is, therefore, suitable for general hatchery workers without any special expertise required. The gel form is produced utilizing an edible polysaccharide gel preferably a temperature setting

alginate or carrageenan gel, most preferably kappa carrageenan Bengel MB 910. The final concentration of the edible gel in the gel form is between 1 and 2.5 percent, preferably between 1 and 2 percent, more preferably between 1.25 and 1.75 percent and most preferably about 1.25 percent. The use of the edible polysaccharide gels of the present invention results in a gel which forms in about 3 to 5 minutes at 4°C which maintains the vaccine organisms in uniform suspension and allows for more uniform exposure of the poultry hatchlings to the vaccine organisms. The low content of the edible gum in the gel form means that approximately 95 percent or more of the gel form is water which can aid in the hydration of the bird and induce the feeding response.

Although various preferred embodiments of the present invention have been described herein in detail, it will be appreciated by those skilled in the art, that variations may be made thereto without departing from the spirit of the invention or the scope of the appended claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A gel form of a live vaccine for administration of live organisms to poultry hatchlings, the gel form comprising approximately 1 to 2.5 percent of a temperature setting edible polysaccharide gelling agent having suspended therein sufficient levels of live organisms to provide for immunization of a poultry hatchling flock.

2. A gel form of a live vaccine according to claim 1 wherein the live organisms are oocysts of Eimeria.

3. A gel form of a live vaccine according to claim 2 wherein the oocysts are selected from one or more of Eimeria tenella, Eimeria necatrix, Eimeria acervulina, Eimeria maxima, Eimeria brunetti, Eimeria proecox, Eimeria mivati and Eimeria mitis.

4. A gel form of a live vaccine according to claim 3 wherein the oocysts are selected from one or more of Eimeria tenella, Eimeria acervulina and Eimeria maxima.

5. A gel form of a live vaccine according to claim 4 wherein the vaccine contains between about 100 and 500 oocysts per ml.

6. A gel form of a live vaccine according to claim 5 wherein the vaccine contains between about 200 and 300 oocysts per ml.

7. A gel form of a live vaccine according to claim 6 wherein the vaccine contains about 250 oocysts per ml.

8. A gel form of a live vaccine according to claim 7 wherein the vaccine contains about 1.25 percent of an edible polysaccharide gelling agent.

9. A gel form of a live vaccine according to claim 8 wherein the edible polysaccharide gelling agent is a kappa carrageenan.

10. A method for immunizing a poultry flock utilizing a live vaccine of viable organisms, the method comprising:

a) preparing a gel form of a live vaccine by:
   i) preparing a suspension of the viable organisms in cold water,
   ii) dissolving an edible polysaccharide temperature dependent gelling agent in an aqueous solution at or above the melting point of the polysaccharide gelling agent,
   iii) mixing the organism suspension and the gelling agent solution,
   iv) pouring the mixture into a suitable container then allowing the mixture to cool and gel to produce a gelled live vaccine comprising from about 1 to about 2.5 percent of an edible polysaccharide gel having suspended therein sufficient levels of the organism to provide immunization to the flock, and
b) allowing the poultry flock to feed from the gelled vaccine suspension.

11. A method according to claim 10 wherein the live organisms are oocysts of Eimeria.

12. A method according to claim 11 wherein the oocysts are selected from one or more of Eimeria tenella, Eimeria necatrix, Eimeria hagani, Eimeria acervulina, Eimeria maxima, Eimeria brunetti, Eimeria proecox, Eimeria mivati and Eimeria mitis.

13. A method according to claim 12 wherein the oocysts are selected from one or more of Eimeria tenella, Eimeria acervulina and Eimeria maxima.

14. A method according to claim 13 wherein the vaccine contains between about 100 and 500 oocysts per ml.

15. A method according to claim 14 wherein the vaccine contains between about 200 and 300 oocysts per ml.

16. A method according to claim 15 wherein the vaccine contains about 250 oocysts per ml.

17. A method according to claim 16 wherein the vaccine contains about 1.25 percent of an edible polysaccharide gelling agent.

18. A method according to claim 17 wherein the edible polysaccharide gelling agent is a kappa carrageenan.

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61K47/36 A61K9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO,A,85 00752 (UNILEVER PLC) 28 February 1985 see claims 1-4,7,8,10,15,17,18 see page 16, line 8 - line 10	1-18
Y	EP,A,0 243 548 (LEE, ENG-HONG) 4 November 1987 cited in the application see the whole document	1-18

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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1

Date of the actual completion of the international search	Date of mailing of the international search report
1 July 1996	15.07.96

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Ventura Amat, A

INTERNATIONAL SEARCH REPORT

Information on patent family members

In' tional Application No
PCT/CA 96/00100

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A-8500752	28-02-85	AU-B-	564879	27-08-87
		AU-B-	3211584	12-03-85
		CA-A-	1230554	22-12-87
		DE-A-	3470004	28-04-88
		EP-A,B	0134703	20-03-85
		GB-A,B	2144331	06-03-85
		IE-B-	58017	16-06-93
		JP-T-	60501955	14-11-85
		SU-A-	1528329	07-12-89
EP-A-243548	04-11-87	CA-A-	1204057	06-05-86